

Draft Response to Eden Review of June 1986

5. Fly Security

- a. ARS will maintain a vigorous program to assure strict fly security in research facilities.
- b. When requested by the Commission, ARS scientists will participate on the Fly Security Committee.

16. Methods Development

- a. Every effort will be made to increase productive interactions and cooperation between research and Methods Development activities, while maintaining continued ARS autonomy for long-term research responsibilities.
- b. A review will be made of existing methods to monitor the rate and degree of adaptation (deterioration) of production strains, and protocols will be developed for monitoring strain adaptation using the most modern technologies available. An ad hoc committee to address this question is being formed with Dr. C. J. Whitten (Chairman), Dr. R. L. Mangan, and Dr. D. B. Taylor from ARS and 2 additional members to be appointed by the Screwworm Commission.
- c. Research will continue on new diets, gelling agents, and formulations, and these will be provided to Methods Development for evaluation under conditions of mass production.

17. Research

- a. ARS will maintain its autonomy, emphasizing long-term research while cooperating with Methods Development to assure that new discoveries are rapidly incorporated into the program.
- b. ARS agrees that costs associated with emergency assistance (such as outbreaks north and west of the barrier) should be provided by the screwworm commission. Precedent for this arrangement has already been established in the Valle outbreak. A protocol has been developed for emergency investigations of this nature.
- c. ARS will fortify critical scientific areas where deficiencies have been identified as follows:

- (1) Insect rearing/nutrition. A separate project is being developed for physiological aspects of screwworm attraction and nutritional (growth) requirements. An attempt will be made to fill one scientist slot with a physiologist. If this proves impractical, visiting scientists will be used to fill this requirement.

- (2) Population modeling. Dr. Rubink, San Jose, Costa Rica, has been assigned the task of conducting research to construct a computer simulation and model of screwworm population dynamics. He is receiving additional training in these concepts at the Modeling and Bioengineering Research Unit, Insects Affecting Man and Animals Research Laboratory, Gainesville, Florida. A cooperative agreement on screwworm modeling is also in effect with Dr. E. Krafur of Iowa State University and the screwworm research project at Fargo, North Dakota.
- (3) Behavior. Specific aspects of screwworm behavior are being addressed at Tuxtla Gutierrez, Mexico; San Jose, Costa Rica; and Fargo, North Dakota. Should specialized requirements arise, visiting scientists will be brought into the program on an ad hoc basis.
- (4) Systematics. Dr. Mangan has been conducting some research on the biosystematics of blowflies related to screwworms. A formal cooperative project on the biosystematics of the blowflies of southern Mexico and Central America within the Systematic Entomology Laboratory, Beltsville, Maryland, will be considered.

18. Publication of Successful Eradication Technology

- a. ARS scientists are required to publish the results of research findings in the scientific literature - in fact, their promotion potential depends in great measure on their ability to scientifically document the results of their work. This policy will not change.
- b. Response to criticisms of the screwworm program in scientific journals has been, and will continue to be, made by ARS scientists in the most effective way possible. For example, the article in Science by Richardson et al. on genetic isolation of screwworm populations was immediately refuted in a response by ARS scientists. Similarly, the Readshaw commentary in Nature on climate has been evaluated by ARS scientists and a response prepared. The dilemma is whether or not to even recognize such a blatantly uninformed hypothetical commentary with a direct response. Perhaps, a more scientific and effective way to counteract these instant experts is through normal scientific documentation with analytical conclusion backed by scientific data which effectively refute the unsubstantiated hypotheses.

19. Strain Development and Replacement

- a. ARS will continue to develop new strains for production and, until advised otherwise by APHIS, recognizes this responsibility as a number one priority. A protocol has evolved in which both research and methods development share strain development activities with ARS making initial collections, selecting lines, and defining crossing schemes, while Methods Development participants in a gradually increasing role as the strain approaches incorporation into the plant.

- b. ARS strongly supports the recommendation that the mass-reared strain should have a separate brood stock that receives great care and is precisely monitored for changes.
- c. ARS does not agree with the suggestion of adding new flies to an existing colony. [Perhaps Mangan or Taylor would add a brief scientific rationale that would kill this idea before it goes too far.]

June 27, 1986

W. G. Eden Review of the
Mexican-American Screwworm
Eradication Program

J. E. Novy
Co-Director
Mexico-U.S. Commission for
the Eradication of Screwworms
Mexico City, Mexico

Enclosed is a copy of the W. G. Eden Review of the Mexican-American Screwworm Eradication Program. In a meeting with Mr. B. W. Hawkins, Administrator, Dr. Eden emphasized Fly Security, Field Surveillance with Information Support, Program Quarantine, Methods Development (too many projects without adequate priorities to assure work accomplishment and several development activities that are actually basic research), Strain Development and Replacement, Labor Relationships, Liaison with other Global Insect Control Programs, and Subsequent Review.

I would appreciate your review of this document and receipt of your comments by September 1, 1986, outlining any appropriate action you and/or the Commission plan to implement.

/s/ W. W. Buisch

W. W. Buisch
Assistant Deputy Administrator
International Programs
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Enclosure

cc:

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A REVIEW

of the

MEXICAN-AMERICAN SCREWORM ERADICATION PROGRAM

Animal and Plant Health Inspection Service

U. S. DEPARTMENT OF AGRICULTURE

June, 1986

by

W. G. Eden

CONTRACT NO. 53-3294-6-0016

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A REVIEW OF THE MEXICAN-AMERICAN
SCREWORM ERIDICATION PROGRAM

Report Summary

Recommendations

1. Changing Concepts

- (1) Make a concerted effort to assign "action people" to "action jobs" and "exacting, detail-oriented" people to the more structured work.

2. Personnel Management

- (1) Enhance opportunities for professional growth and development within the screwworm program, and provide employment options for those who leave.
- (2) Continue to provide incentives for employment and attempt to eliminate counterproductive barriers to recruiting the best qualified applicants.
- (3) Instigate a rotational system for exchanging employees within VS or between VS and PPQ.
- (4) Improve employee orientation to the screwworm program and associated foreign cultures.

3. Excess Personnel

- (1) Immediately take the action required to terminate unneeded employees, perhaps by loaning Mexico the necessary funds.
- (2) Take all possible measures to assure that this kind of paradoxical condition does not recur.

4. Production

- (1) Focus all efforts first on the best possible rearing of screwworm larvae.
- (2) Seize the opportunity provided by reduced production to establish and maintain high maintenance standards.

- (3) Avoid the pitfalls associated with pursuing more interesting methods improvement activities to the detriment of routine maintenance.
- (4) Critically assess the entire mass rearing system, identify potential improvements, establish priorities, and work with Research and Methods Development to assure their implementation.

5. Fly Security

- (1) It is mandatory that total fly security be developed. This can be done only by a total commitment by all employees. Any laxness on the part of supervisory personnel must be dealt with severely.
- (2) Increase the wounded-sheep surveillance activity in the area surrounding the plant.
- (3) As potential hazards are discovered and responsibility for correction established, failure to immediately make the correction must result in severe disciplinary action.
- (4) Inadvertent failure to observe fly security regulations must be dealt with in severe terms.
- (5) Select a group (not more than three) of people from outside the "screwworm family" to conduct a detailed review of all aspects of fly security, including complete and detailed structure inspection, twice per year and report directly to the Commission while it is in session.
- (6) Maintain the current Fly Security Committee and guard against complacency. A copy of its reports should be distributed to all persons who receive copies of the Screwworm Weekly Operations Report.

6. Plant Security

- (1) Utilize the best available specialists to develop a system to prevent acts of terrorism in the fly production facility at Tuxtla Gutierrez.

7. Water Supply

- (1) Search for a reliable back-up water supply.
- (2) Concurrent with the search, give consideration to increasing the present water storage capacity and to studying what requirements must be met to re-use water from the sewage effluent.

8. Waste Disposal

- (1) Put the old filtration pits on the line with the new lagoons and service the filtration media on an appropriate schedule.
- (2) Change to the new incinerator as soon as possible, and keep the old one maintained as a standby.
- (3) Maintain some type of basic records for water discharge on general bacterial count and solid content to combat future pollution criticisms. Tests for heavy metals, radiation and other complicated tests are not advised.

9. Plant Maintenance

- (1) Improve the cleanliness and orderliness of all areas within the plant and its associated structures.
- (2) Increase the emphasis on maintenance of the structure, both inside and outside the plant.
- (3) Maintain a constantly updated master blueprint of all facilities and grounds.
- (4) Remove and discard unusable equipment.

10. Field Surveillance

- (1) Meet with all SARH agencies and improve their involvement in field surveillance for screwworm outbreaks. Explore their roles and specific needs for information materials.
- (2) Involve a public personality in the mass media campaign for screwworm surveillance. A good example would be a popular baseball or soccer player for TV and radio spots.
- (3) Develop new movie films of program progress and a specific film on the importance of field surveillance.
- (4) Develop a public relations campaign with agricultural representatives of the various universities in their Departments of Entomology or Biology.
- (5) Encourage development of technology to improve surveillance.

11. Fly Barrier

- (1) Continue the maintenance of the barrier.

12. Program Quarantine

- (1) Construct a temporary inspection and dipping facility at Agua Dulce for horses and mules. This facility could greatly speed up the movement of animals through this critical point. A 5½ hour delay for trucks at the inspection station is asking for a loss of confidence in the entire quarantine line. Prefabricated and movable facilities are suggested for all new animal handling facilities.
- (2) Improve the water supply system at the Agua Dulce location. The addition of overhead tanks for storage would help to provide adequate shower facilities and drinking water for both employees and livestock.
- (3) Provide hand tools, uniforms, rubber boots and first aid supplies for employees. General safety and living conditions for personnel could be greatly improved.
- (4) Consider some types of improvements for employees, such as a public telephone, and/or perhaps a television set for army troops and employees.
- (5) A better effort should be made to accomodate and educate truck drivers hauling cattle. Pass out program literature and small souvenirs.
- (6) Provide a better lighting system for work at night at the highway and within the facilities.
- (7) Consideration should be given to (1) moving the quarantine stations easterly as the critical line moves and (2) assurance that railroad traffic is adequately inspected.

13. Information and Public Education

- (1) Consider the advice of a consultant team of three members to evaluate and provide future planning and innovative strategies for the information section. Special techniques and programs will be needed to enhance public information activities.
- (2) Administrative planning and innovative methods for the information program will increase in importance. The screwworm program needs the services of a full-time information officer under the direct supervision of the program co-directors.
- (3) Provide a computer system for document preparation and graphics for the information section. This must include the capabilities of envelope addressing and stuffing.

- (4) It would be helpful to develop new movie films to aid in public education. A film on the current status of the entire program would be helpful. A second film is needed to stress the need for the screwworm surveillance. It should stress the game plan to maintain fly-free areas and the role to be played by each group in the public and governmental sectors.
- (5) The initial effort for honorary field inspectors should be updated with a survey of participants, additional information and expanded involvement.
- (6) Mass media efforts should be planned to inform the public of program benefits when available. Let the public know its money invested in eradication is paying excellent dividends.

14. Fly Distribution

- (1) Make the Omega or another accurate and dependable guidance system work for locating and following flight patterns.
- (2) Abandon the chilled fly concept.
- (3) We urge that the conflict about the small box system be resolved.

15. Yucatan, Guatemala and Belize

- (1) Proceed with eradication work in Mexican states on the Yucatan Peninsula, and simultaneously proceed to establish agreements for eradication in Belize and Guatemala.

16. Methods Development

- (1) Conduct quality control monitoring of screwworm production and routine bioassays of all rearing materials to assure their purity.
- (2) Accept significant responsibility for security at the screwworm production facility and all measures required to prevent fly escape.
- (3) Seek and evaluate the best technology from every possible source to improve materials and equipment for screwworm mass production and utilization.
- (4) Investigate facility design and operation protocols in anticipation of needs in Central America.
- (5) Continue to develop and maintain closer liaison and mutually beneficial working relationships with ARS.

*us on
production
& brain
nutrition + genetics
also
screen head
w fly security*

17. Research

- (1) Continue to work closely with ARS and support its research to discover new technologies for screwworm control.
- (2) Help preserve the independence and stability of long-term research by using the consultative and training capabilities of the ARS staff, keeping direct involvement to a minimum.
- (3) Provide for payment of costs required to obtain emergency assistance from ARS.

18. Publication of Successful Eradication Technology

- (1) Continue to practice effective screwworm pest management by taking advantage of every possible method for reducing or eliminating their occurrences.
- (2) Take the initiative in documenting the unequivocal success of the sterile insect technique.
- (3) Aggressively and expeditiously refute the claims of misguided critics by cooperatively publishing positive rebuttals.
- (4) Insist that ARS and other scientists participate in documenting successful eradication technology and determining its scientific basis.

19. Strain Development and Replacement

- (1) Continue using the existing strain development and replacement protocols, particularly collection of enough egg masses to assure adequate levels of genetic heterozygosity and rearing that provides for an estimate of their viability (i.e. isofemale lines.)
- (2) The mass-reared strain should have a separate brood stock that receives great care and is precisely monitored for changes. All production processes should be monitored to assure quality rearing.
- (3) Field performance should be monitored to determine the competitiveness of released strains and they should be replaced only if deemed inadequate.

20. Computerization

- (1) Inventory the total computer hardware and programs on hand.
- (2) Utilize computer expertise, either inside or outside of the Program, to make full use of computer potential for the Program.

21. Labor Relationships

- (1) Develop strategies to exclude the Mexican labor union from the labor management system if international agreements are developed for future multi-national programs.
- (2) Develop written documents to resolve special "one time" labor problems which appear to have no clear resolution under existing operating procedures.

22. Relationship with Mexico

- (1) Follow through on cross-national agreement on short and long range program goals as set forth in Section 23.
- (2) Maintain constant training and orientation on the need for conciliatory attitudes by both U.S. and Mexican nationals.

23. Short and Long Range Program Plans

- (1) Have a committee of strategists to develop and document both short and long range goals with a clear anticipation of events for each facet of the screwworm program.
- (2) Formulate a long range plan for allocating resources and managing labor.

24. Liaison with Other Global Insect Control Programs

- (1) Link the management and operation of Mexican and Central American global insect control programs to encourage the sharing of solutions to common problems and thereby avoid wasteful redundancy.

25. Documentation of the Screwworm Eradication Program

- (1) Follow through with the contractor to ensure timely preparation and completion of the document.

26. Program Benefits in Mexico

- (1) Develop a public information program to demonstrate the economic returns for public funds invested in screwworm eradication.
- (2) Initiate a background data collection effort in Belize and Guatemala to document the infestation level of screwworms and the economic losses associated with the pest in these two areas. This must be initiated in the near future before eradication efforts are started.

27. South of the Barrier Zone

- (1) That the U.S. proceed, under whatever international arrangements are feasible, to plan and carry out an eradication program to the Darien Gap.

28. Subsequent Review

- (1) Plan a review by non-APHIS scientists at a logical time during 1987.

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REVIEW OF THE MEXICAN-AMERICAN
SCREWORM ERADICATION PROGRAM

1986

I. INTRODUCTION

The Review Team, which was composed of the same scientists that conducted the review in 1984, consisted of:

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Following a one-day-orientation for the team leader in APHIS-VS headquarters in Washington, D.C., the Review Team spent the period of May 7-15 in Mexico. Two days were devoted to orientation and updating of the status of the program in the headquarters of the Mexico-American Commission for the Eradication of Screwworms in Mexico City. Program personnel gave us a good, candid discussion of the current organization and operation of the program. It included information on the principal responsible officials (American and Mexican), budgets, current locations of native fly infestations,

status of the barrier at the Isthmus of Tehuantepec, fly production and distribution, surveillance operations, information program, quarantine operations, and plans for operations in the Yucatan Peninsula. We asked many questions to which we received straightforward answers.

We traveled to Tuxtla Gutierrez where we toured the fly production facility, the surrounding grounds, and the sewage disposal system. In addition to seeing the facilities and their operations firsthand we had the opportunity for questions and discussions. Also at Tuxtla Gutierrez we toured the packaging and distribution operations at the local airport and talked to the personnel there.

The Agricultural Research Service unit at Tuxtla was toured and extensive discussions were had with scientists there. We were also fortunate to have a good discussion with Dr. Jim Whitten who coordinates screwworm research at Tuxtla Gutierrez, Mission, Fargo, and in Costa Rica.

While our plans for examining the quarantine stations (four of them) were interrupted, we did see the one at Cinco Cerros and the largest and most important one at Agua Dulce. At Agua Dulce we observed operations for several hours and had the opportunity to talk to personnel at the station and to cattlemen, drivers, and the military.

The Team then returned to the United States. After a two-week period of study and discussions with other scientists, the Team met in Gulf Shores, Alabama, to discuss its findings, deliberate upon them, and prepare this report.

Program people, both U.S. and Mexican, at every location we visited were courteous, gave instintingly of their time, helped us in our movements about the country, were totally candid in response to our questions, and helped us in more ways than we can report here. We are most appreciative to them as

well as to the numerous cattlemen and others with whom we talked. Appreciation is also expressed to the contracting officer's representative, Mr. William Sudlow, for his excellent assistance in many ways that provided for smooth operation of the review.

As Team Leader, I want to make a special statement about Drs. Hoelscher, Leppla, and Meadows. I have had the pleasure and privilege of working with these fine scientists for several reviews of the screwworm program. I have worked with many scientists in various program reviews over the world in recent years. I continue to be impressed by their knowledge about the screwworm organism and their scientific competency, judgment, frankness, pragmatism, and freedom from bias as we delve into the many facets of program planning and operations. The Team Leader (contractor) assumes full responsibility for what is included in this report, but the report could not have been done without the input of Drs. Hoelscher, Leppla, and Meadows.

II. STATUS OF THE SCREWORM PROGRAM

The screwworm has been eradicated in Mexico from the U. S. border to the 92nd meridian with the exception of a few cases in the lower part of the barrier. These cases apparently came in from the Yucatan Peninsula or Guatemala. Those infested areas created pressure on the quarantine line, so the original U.S.-Mexican agreement was amended to permit the release of sterile flies in the infested areas in Mexico and in Belize and Guatemala (with the approval of those governments.) This should remove the pressure from the present barrier and quarantine line and possibly result in moving the barrier further south to a more desirable location.

The eradication to the Isthmus and the establishment of the barrier has been highly successful. The program now consists of a vast surveillance and information program in the north, the maintenance and monitoring of the barrier and quarantine line, the recently initiated eradication operation in the Yucatan, and planning for moving the eradication effort into Guatemala and Belize.

The five regions of the program have been consolidated into three. Regions I and II consist of all of Mexico north and west of the barrier. These regions have the tremendous responsibility of locating any case of screwworms that occurs north and west of the barrier. This task is to be accomplished with about 39 percent (some 75 people) of the original group of over 200.

Region III is responsible for maintaining the barrier and quarantine line and the control or elimination of screwworms from the infested areas south and east of the barrier. The above item will be discussed in more detail elsewhere in this report.

The success of the program during the past year has been excellent. It weathered one serious challenge resulting from an outbreak in the area surrounding the city of Valles. The outbreak, which was possibly the result of sabotage, was quickly discovered and eliminated. The outbreak was an excellent test of the emergency eradication procedures and personnel. All systems responded in good order. The quick and successful action resulted in increasing the confidence and morale of the personnel.

The plan, when conceived, was to establish a biological barrier in the narrow isthmus and hold the screwworm organisms below the barrier. This "holding" operation involved essentially two parts: the repeated dispersion of sterile flies over the barrier zone and the operation of quarantine stations along routes where animals were moved. The operation and maintenance of the barrier began in late 1954; the two techniques indicated were put in use. This operation is still in effect.

The change from an "eradication mode" to a "barrier maintenance" one at first thought should be "a piece of cake". Fly production was reduced about half; distribution operations were, of course, reduced similarly. Many less people were involved and budgets were reduced. These changes were obviously anticipated. However, the required change in attitude of valuable personnel devoted to eradication technology is not quite so simple. Some of the best and most effective technologists in eradication "live and think eradication" constantly; they are invaluable. Yet, such people find it difficult to adjust to the more mundane tasks of barrier maintenance. Concerted efforts must be made to keep the "action oriented" people happy while carrying on a less glamorous program of barrier maintenance.

III. ANALYSIS AND RECOMMENDATIONS

1. Changing Concepts

When the screwworm eradication program began in Mexico in 1972 it had one primary, over-riding objective: to remove the insect from the land mass of Mexico from the U.S. border to the Isthmus of Tehuantepec. All of the fiscal resources of the program and the energy and ingenuity of program personnel were devoted to that objective. Eradication was successfully completed by the end of 1984.

The plan, when conceived, was to establish a biological barrier in the narrow Isthmus and hold the screwworm organism below the barrier. This "holding" operation involved essentially two parts: the repeated dispersion of sterile flies over the barrier zone and the operation of quarantine stations along routes where animals were moved. The operation and maintenance of the barrier began in late 1984; the two techniques indicated were put in use. This operation is still in effect.

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We are aware, of course, of the recently begun eradication efforts in the Yucatan and of the thinking and planning to perhaps extend the eradication zone to the Darien Gap. As will be seen in other parts of this report, we support these approaches. However, the problem of adjusting attitudes will continue to be there wherever and whenever the eradication program is halted.

Recommendation:

1. Make a concerted effort to assign "action people" to "action jobs" and "exacting, detail-oriented" people to the more structured work.

2. Personnel Management

High levels of performance and job satisfaction exist in all segments of the screwworm eradication program. Most of the employees are adequately trained and supported relative to their assignments. There is some concern, however, about limits on opportunities to grow professionally within the program, particularly the existence of "deadend" positions. The degree of commitment and quality of contribution expected from professional employees warrants a well-organized system for providing career continuity. In the event that the program is discontinued or an employee elects to leave, specific options should exist for appropriate employment. The question was asked, "What after Tuxtla?"

The program continues to have incentives that make it increasingly attractive to prospective employees but recruiting is exacerbated by regulations that require all candidates to already be U.S. government employees. *check w/ FPS to see if there is provision exception*
This precludes hiring some of the best qualified applicants. Furthermore, there is no back-up talent for key positions. This could become critical since many of these positions involve employees that are near retirement age or have been away from the U.S. for a long period of time. Perhaps a rotation system could be instituted for exchanging assignments within VS or between VS and PPQ. Some turnover is worthwhile to rejuvenate seasoned employees and provide opportunities for new ones with fresh attitudes and needed skills. However, the rate should be carefully regulated. Most of these constraints can be eliminated, or at least circumvented, by communicating their negative impact on the program.

One subject that should receive greater emphasis is the orientation of employees to the screwworm program and to the affected foreign cultures.

Language training is only the beginning. Continued adjustment could be facilitated by planning social functions, circulating a newsletter, sharing resources, and encouraging other activities that stimulate interdependence. It also might be worthwhile to foster community involvement and increased foreign travel. There could be a greater appreciation for teamwork if employees in different assignments experienced each other's roles. For example, personnel in the plant might feel a greater sense of accomplishment if they could occasionally participate in releasing their flies. Finally, reorientation should be provided for family members who are returning to the U. S.

Recommendations:

1. Enhance opportunities for professional growth and development within the screwworm program, and provide appropriate employment options for those who leave.
2. Continue to provide incentives for employment and attempt to eliminate counterproductive barriers to recruiting the best qualified applicants.
3. Instigate a rotational system for exchanging employees within VS or between VS and PPQ.
4. Improve employee orientation to the screwworm program and associated foreign cultures.

3. Excess Personnel

Eradication of the screwworm from most of Mexico has resulted in a major reduction of the workforce. Distribution centers, such as those at Tampico and Guadalajara, have been essentially closed and the associated field work consolidated. Surveillance activities north and west of the critical line now require only about 80 personnel. Many of those who were no longer needed left the program or transferred to locations further south. More than 100 others are supposed to be terminated but they remain on the Commission payroll because the Mexican government cannot afford their severance pay (indemnification). The U.S. is not responsible for the costs of termination but must pay 80 percent of the salary money for unneeded employees. Both Mexican and U.S. members of the Joint Commission are attempting to find a solution but they are concerned about establishing a precedent for further reductions in force. We feel it is imperative that this problem be solved without further delay.

Many potentially damaging problems arise when unneeded employees are retained. It has a demoralizing effect on other workers, is an unnecessary expense, and is morally wrong. Most of those who are entitled to be paid for termination have faithfully served the program. Now, they are unwanted but they cannot afford to leave. This creates dissatisfaction and long-lasting distrust. It potentially undermines invaluable goodwill that has developed over many years of useful service.

Recommendations:

1. Immediately take the action required to terminate unneeded employees, perhaps by loaning Mexico the necessary funds.

2. Take all possible measures to assure that this kind of paradoxical condition does not recur.

4. Production

The purpose of an insect mass rearing facility is to efficiently produce a continuous supply of high quality insects. This is accomplished through economy of effort and expense, dependability at the required level of production, and assurance of specified quality. The rearing system is optimized and maintained at peak effectiveness by timely performance of all the routine operations. We found screwworm production to be reasonably stable at the 300 million per week level, and there was a general appreciation for the static nature of plant operations.

Maintenance level production at the screwworm plant does not require full utilization of the facilities, so there is an opportunity to perform much needed maintenance and renovation. Antiquated and unused equipment, such as the sawdust handling machines, could be eliminated. More patching and painting could be done along with pest control to reduce the number of cockroaches, houseflies, beetles, ants, and other unwanted organisms. It might also be inadvisable to keep pet cats in the plant. Cleaning is an ongoing task that requires constant attention. Plant security must be assured and it should not be possible for untreated flies to pass through the irradiator.

Tremendous improvements could be realized by reevaluating each component of the screwworm mass rearing system and changing those that are relatively inefficient or ineffective. It is important, however, to define the distinct duties and responsibilities of Production, Methods Development, and Research. We are concerned that one of these units might perform the functions of another and thereby jeopardize their own. Production is restricted to the implementation of existing potential improvements and communication of needs, Methods Development evaluates new technologies and adapts them

to the existing system, and Research discovers or invents entirely new operations. Certainly all available talents should be employed through active exchange and participation but research should never be conducted in the context of production.

The review team identified many areas of potential improvement in the screwworm mass rearing system. In recent years, new synthetic gelling agents have shown great promise in larval diet. We have repeatedly recommended the maintenance with extra care of a brood colony separate from production. It might be advantageous to extend the egging interval or repeat the egging process. Cold rooms seem rather elaborate for the simple task of fly disposal. Alternatives to the routine use of hot rooms for waste disposal should be investigated. Labor could be saved in many ways that might also improve fly quality. Computerized quality control systems are available for routine monitoring and optimization of all insect rearing operations. Finally, routine bioassays should always be conducted on the materials and supplies.

Recommendations:

1. Focus all efforts first on the best possible rearing of screwworm larvae.
2. Seize the opportunity provided by reduced production to establish and maintain high maintenance standards.
3. Avoid the pitfalls associated with pursuing more interesting methods improvement activities to the detriment of routine maintenance.
4. Critically assess the entire mass rearing system, identify potential improvements, establish priorities, and work with Research and Methods Development to assure their implementation.

5. Fly Security

We cannot overemphasize the importance of fly security at the plant in Tuxtla Gutierrez. The plant, by its very nature, is essentially an island of fertile flies surrounded by a fly free area. The nearest infested area is over 100 miles away. Earthquakes and other "acts of God" we have to live with, but the escape and/or deliberate removal of fertile insects from the plant must be eliminated. It must be realized that the more successful the eradication efforts are, the greater is the cost of a security break.

Fly security seems much improved since our review in 1984, but it must be improved further. We saw live fly larvae in the ditch behind the plant. The vestibules to the hot rooms and the hot rooms themselves are in need of repair. Some cracks in the walls of the building were not repaired. The potential for personnel to remove fertile flies still exists. For example, the pass from the production area to the radiation area is a potential security problem. More meticulous care must be exercised around the incinerator. We were advised that some fertile egg masses had been collected in the current wounded-sheep surveillance program but had not been reported through channels. We were told that the Fly Security Committee activity was not successful because it was not being taken seriously and that breaks in security were slow to be corrected, were temporarily patched, or were sometimes ignored. Thus, we conclude that fly security must be greatly improved.

Personnel must think and live fly security. With many years of exposure to an essentially low-key security program (before the critical line moved south to the plant) it will be a Herculean task to bring a

change in attitude about it. It must be done, and it must start with top management.

Recommendations:

1. It is mandatory that total fly security be developed. This can be done only by a total commitment by all employees. Any laxness on the part of supervisory personnel must be dealt with severely.

2. Increase the wounded-sheep surveillance activity in the area surrounding the plant.

3. As potential hazards are discovered and responsibility for correction established, failure to immediately make the correction must result in severe disciplinary action.

4. Inadvertent failure to observe fly security regulations must be dealt with in severe terms.

5. Select a group (not more than three) of people from outside the "screwworm family" to conduct a detailed review of all aspects of fly security, including complete and detailed structure inspection, twice per year and report directly to the Commission while it is in session.

6. Maintain the current Fly Security Committee and guard against complacency. A copy of its reports should be distributed to all persons who receive copies of the Screwworm Weekly Operations Report.

6. Plant Security

The success of the eradication program in Mexico is one of the outstanding biological accomplishments of modern times. It has required great sums of money by both the U.S. and Mexico. The efforts and ingenuity required for this success are almost beyond comprehension. We see no reason why, with sufficient determination, the current status of screwworm distribution (no insects above the barrier) cannot be maintained and further depressed toward the Darien Gap.

While we have no reason for suspecting that the production facility would suffer from some act of terrorism, we simply want to point it out. The U.S. and its close international friends (like Mexico) are currently subjected to various acts of terrorists. We shudder to think of the results and costs of an act that would result in the release of thousands of fertile flies into the countryside. It could require massive resources and several years to bring the situation back to where it is now.

Efforts should be instituted to prevent such an occurrence. While we have little or no knowledge of specific actions that would decrease the possibility of terrorist acts, there are those who have knowledge and experience in this area. We would not consider it inappropriate for top management to utilize such specialists to develop a system of security against terrorism.

Recommendation:

1. Utilize the best available specialists to develop a system to prevent acts of terrorism in the fly production facility at Tuxtla Gutierrez.

7. Water Supply

The loss of water to the plant is still a very dangerous possibility. This could result in the actual closing of the fly production facility. Many thousands of dollars have been spent in trying to remedy this weakness in the program with no apparent success. We feel that it is imperative that a reliable back-up water supply be found. This project should have a high priority and be accomplished as soon as possible.

Concurrent with the search for an additional water supply, consideration should be given to increasing the current water storage capacity. Further, if the old filtration pits are tied into the lower end of the two current sewage lagoons as we have suggested elsewhere in this report, the effluent should be considered as a possible water source. Additional treatment, such as chlorination, might be required.

Recommendations:

1. Search for a reliable back-up water supply.
2. Concurrent with the search, give consideration to increasing the present water storage capacity and to studying what requirements must be met to re-use water from the sewage effluent.

8. Waste Disposal

Waste disposal from the production plant has been a point of concern since the plant was put into operation. The program has received some unfavorable publicity relative to its waste disposal operations.

The recently reworked lagoons with the several aerators in the first one have resulted in great improvements in disposal of liquid waste. While the effluent leaving the second lagoon is not clear, it is much cleaner than the flow from the lagoon previously. If the old filtration pits containing rock, gravel, and sand were put into the effluent flow stream the effluent would be even cleaner before it is released into the river. General water quality tests should be routinely conducted on discharge water. A record should be maintained for local public health officials. Constant vigilance on the aerators in the first lagoon is indicated. One of them stopped during our stay in Tuxtla Gutierrez. Perhaps this was due to improper installation, but they should be checked frequently.

The old incinerator for solid waste seemed to be operating satisfactorily. The oil pan on the bottom is an innovative idea to catch any live larvae that may escape incineration. The new, larger, more mechanically reliable incinerator should be put on line as soon as possible. The old one should be properly maintained for use as a standby when the new one needs maintenance.

Recommendations:

1. Put the old filtration pits on the line with the new lagoons and service the filtration media on an appropriate schedule.
2. Change to the new incinerator as soon as possible, and keep the old one maintained as a standby.

3. Plant Maintenance

3. Maintain some type of basic records for water discharge on general bacterial count and solid content to combat future pollution criticisms. Tests for heavy metals, radiation and other complicated tests are not advised.

From the standpoint of efficient production of wastewater but also for public relations and good aesthetics the facility should exhibit, both inside and outside the plant and throughout the grounds, the system of plantiness, orderliness and day-to-day maintenance.

Our observations indicate that some improvements would be helpful. Plants should not be growing from the building foundation; extensions from the main building should be structurally maintained, properly painted, and kept clean and orderly; there should be a minimum storage of open dishes and trays; dishes should be kept clean and appropriately decorated with ornamental plants. Cracks and fissures in building walls, roofs, floors, etc., should be kept constantly repaired.

Storage and repair areas within the plant should be kept clean and orderly. Heavy layers of dirt and fragments of materials should be removed. Covered containers should be kept tight and orderly.

There is, by necessity and good management, a rather continuous amount of structural change and repair work being done in the plant. There should be a master blueprint of the entire facility kept up to date at all times. Every pipe, electrical circuit, hole made in masonry construction, door changed, etc., should be indicated on such a master blueprint. Likewise, the same information should be kept up to date on areas outside the plant such as the electrical circuits, pipes, etc., associated with the sewage lagoons.

9. Plant Maintenance

The fly production facility at Tuxtla Gutierrez is very probably the largest facility of its kind in the world. It is known throughout the world, and it has many visitors in the course of a year. Thus, not only from the standpoint of efficient production of screwworms but also for public relations and good aesthetics the facility should exhibit, both inside and outside the plant and throughout the grounds, the epitome of cleanliness, orderliness and day-to-day maintenance.

Our observations indicate that some improvements would be helpful. Plants should not be growing from the building foundation; extensions from the main building should be structurally maintained, properly painted, and kept clean and orderly; there should be a minimum footage of open ditches and these should be kept clean and appropriately secluded with ornamental plants. Cracks and fissures in building walls, walks, steps, etc., should be kept constantly repaired.

Storage and repair areas within the plant should be kept clean and orderly. Heavy layers of dust and fragments of materials should be removed. Opened containers should be kept tight and orderly.

There is, by necessity and good management, a rather continuous amount of structural change and repair work being done in the plant. There should be a master blueprint of the entire facility kept up to date at all times. Every pipe, electrical circuit, hole made in masonry construction, door changes, etc., should be indicated on such a master blueprint. Likewise, the same information should be kept up to date on areas outside the plant such as the electrical circuits, pipes, etc., associated with the sewage lagoons.

As we toured the plant this year we were again bothered by the presence of obvious so-called "white elephants" in the plant. We particularly noted the large medium mixing tanks and the sawdust handling tanks. These large devices have been essentially unused since installation or shortly thereafter. They are collecting dust and debris, are thus unattractive, and take up considerable space that might very well be more efficiently utilized. They should be dismantled, removed, and sold for scrap unless some utility can be made of them.

Recommendations:

1. Improve the cleanliness and orderliness of all areas within the plant and its associated structures.
2. Increase the emphasis on maintenance of the structure, both inside and outside the plant.
3. Maintain a constantly updated master blueprint of all facilities and grounds.
4. Remove and discard unusable equipment.

10. Field Surveillance

The task of quickly detecting an outbreak of screwworms in the present eradicated area north of the present critical line is a job of prime importance. Maintenance of a fly-free status in the large land mass north of the 93rd meridian will be a key item to program operations in the future. Reinfestation of previously free areas is a constant threat to present and future program operations. Infested animal movements, natural fly mobility and the possibility of deliberate program sabotage can cause the dreaded outbreak situation. Early detection of new outbreaks must be accomplished with no room for error.

Presently, field surveillance is conducted by field inspectors and the cooperative assistance of livestock owners. Suspect blowfly samples are collected and sent for positive identification to determine the presence or absence of screwworms. Ranchers, veterinarians, and cattlemen union members are constantly urged to cooperate in the effort to detect reinfestation. The public is prone to lose interest in surveillance after the perceived threat of active cases is past. Livestock passing through the quarantine line are inspected, dipped and traced to their final destination to aid in the elimination of reinfestation. Field inspectors in the fly-free zones inspect animals upon unloading to double check the quarantine process.

A system of honorary field inspectors (private cattlemen recognized at the local level) of 10,000 people has been organized to aid in the country-wide efforts to detect reinfestations of screwworms in Mexico. Special newsletters and literature are mailed to this group on a twice-yearly basis to maintain its program support.

Adequate field surveillance in Mexico presents several special concerns. Many areas are isolated and difficult to physically reach on a routine basis. Ecological diversity and climatic conditions vary widely and favor the development of undetected fly infestations. The urgency of early detection is mandatory to the eradication of future outbreaks. Outbreaks are certain to occur because of the nature and persistence of the pest. It becomes increasingly difficult to maintain long term interest in field surveillance the longer an area is maintained in a fly-free status.

Innovative and effective public information campaigns must be designed and implemented to accomplish the task of field surveillance. The cooperative efforts should be enhanced with agencies of SARH, livestock unions and the Mexican Extension Service to routinely aid in sample submission. The honorary field inspector program will need to be periodically evaluated, updated and strongly supported to keep country-wide interest. Suspect sample submission has been maintained at approximately 2,500 samples per year. It would be great if this number could be expanded to the 10,000 range on an annual basis.

A series of new movie films, visual aids, TV spots, radio spots, radio programs and literature will be needed for the public surveillance effort. A short and long term calendar of events could be developed for each program component of the campaign. The information section in the Mexico City headquarters has a large responsibility for surveillance. Its role will become more important in the next ten years.

Recommendations:

1. Meet with all SARH agencies and improve their involvement in field surveillance for screwworm outbreaks. Explore their roles and specific needs for public information materials.

2. Involve a public personality in the mass media campaign for screwworm surveillance. A good example would be a popular baseball or soccer player for TV and radio spots.

3. Develop new movie films of program progress and a specific film on the importance of field surveillance.

4. Develop a public relations campaign with agricultural representatives of the various universities in their Departments of Entomology or Biology.

5. Encourage development of technology to improve surveillance.

11. Fly Barrier

The success in maintaining and monitoring the barrier has been phenomenal. The critical line has been moved further east to the 93rd meridian and the eastern side of the barrier has been moved to within five miles of Guatemala and is now being extended to the north into Campeche. This has resulted in very few cases being found in the barrier area and no sustained build-up has occurred.

The quarantine line with all its faults seems to be working exceptionally well. The livestock industry including the truckers seem to be cooperating in the overall effort even though many of them are forced to wait long hours to get their cattle across the line.

Recommendation:

1. Continue the maintenance of the barrier.

12. Program Quarantine

The operation and maintenance of a totally effective quarantine line at the Isthmus of Tehuantepec is a major component of the present eradication program. It is evident that the present quarantine system has been performing in a generally satisfactory manner. A total of 300,000 animals have been inspected, dipped and processed for movement into the eradicated zones of Mexico during the past year. During the past six months, only two active cases of screwworm which escaped detection or treatment in the quarantine process have been discovered north of the 93rd meridian. It is evident the present system is not totally effective and could be improved, however the review team would like to compliment the field operations personnel responsible for quarantine operations for their effective work during the past six months. It was evident that the supervisors and workers at the Agua Dulce, Cinco Cerros and Arriaga are dedicated and capable employees.

A visit to the Cinco Cerros and Agua Dulce stations was conducted during the team visit. The Agua Dulce location on the Gulf side is of critical concern to the future operation of the present quarantine line. The April 1986 records for the station indicated that 17,590 animals (15,582 cows, 1,125 horses, 398 sheep and 485 hogs) were processed. These data demonstrate the large amount of animal traffic for which the physical facilities are inadequate. This large volume of livestock is being handled by tremendous amounts of hard work and sheer worker determination. The facility is operated by 3 shifts of 15 workers per shift on a 12 hour rotation. There were 41 animals with open wounds or suspected blowfly infestations quarantined at Agua Dulce during April. None of the suspected cases were confirmed as screwworm.

A tremendous problem has been associated with the movement of horses and mules through a facility designed for handling other livestock. The horses and, especially, mules are reluctant to jump into the dip vat. Workers must physically force stubborn mules to plunge into the dark area displayed by the vat. The open-sided pen area presents a confusing situation to the proper flow of equestrian animals.

The lack of an adequate water supply is resulting in a variety of personnel and facility problems. An employee on each shift is assigned the task of providing drinking water for thirsty animals in the entry pen. Those animals hauled long distances from the Yucatan area immediately consume the small quantity of water provided. Hogs and sheep are not able to drink from the high-sided trough in the reception pen. The availability of water to the animals previous to the dipping procedure is of significant importance. Water-starved animals will drink freely from the dip vat during processing and serious poisoning problems can occur if animals drink the vat liquid. Can one visualize an employee providing drinking water with a barrel and bucket to 17,590 animals within a month?

Army troops, Commission employees, truckers and cattlemen all have to compete for the small water supply provided by the premise well. Bathing, cooking, sanitary facilities, and dip facilities keep a constant drain on available water. A daily supplement of water is purchased from a local source and delivered by truck. Storage is achieved in open 55-gallon barrels. The hot tropical climate and dust from the cattle handling areas provide for a constant source of water contamination in the open barrels.

The road tower for the aerial inspection of truck traffic on the highway was an excellent idea. Unfortunately, this aid, along with other highway

monitoring operations becomes ineffective with the onset of darkness and the nighttime truck traffic was abundant on the highway, but there was no apparent disregard for stopping at the station. Lighting on the inspection line was inadequate and supplemented with hand held flashlights. Army troops were evident at the roadside during daylight but all retired to their quarters at nightfall.

Animal inspections appeared to be very vigorous and satisfactory. Small cuts and scrapes on animals were treated with medication. The dip vat concentration of insecticide was monitored daily. Vat water level is reestablished at the start of each work shift. It appeared that the workers were reaching the point of exhaustion at the end of their 12-hour shift. The volume of work requires a constant effort from employees.

There is cause for concern about the length of time truckers must spend to get their animals inspected, dipped and reloaded. A total of 9 large trucks were waiting at 4:30 p.m. at the facility. By 6:15 p.m. the number of trucks had grown to 17. It required a wait of approximately 5½ hours for the last vehicles to clear the quarantine station. There were still 16 trucks in line for processing at the 9:30 p.m. departure time of a team member. Truckers appeared to be quite patient with the long delay. Their cooperation and assistance could be improved with expanded handling and inspection facilities.

There is concern about a number of working conditions at the busy inspection stations. Communication systems were non-functional at both quarantine stations visited. There was a total lack of hand tools to open, close and handle truck gates and doors. There was a lack of maintenance to gate latches. Workers expressed a need for rubber boots, clean uniforms, shower

facilities, educational literature, communication equipment, a public telephone, and adequate and clean drinking water. There were no apparent first aid facilities or emergency supplies in case of accident or injury. The commission vehicle at the Cinco Cerros facility was in bad repair and would not start.

Recommendations:

1. Construct a temporary inspection and dipping facility at Agua Dulce for horses and mules. This facility could greatly speed up the movement of animals through this critical point. A 5½-hour delay for trucks at the inspection station is asking for a loss of confidence in the entire quarantine line. Prefabricated and movable facilities are suggested for all new animal handling facilities.
2. Improve the water supply system at the Agua Dulce location. The addition of overhead tanks for storage would help to provide adequate shower facilities and drinking water for both employees and livestock.
3. Provide hand tools, uniforms, rubber boots and first aid supplies for employees. General safety and living conditions for personnel could be greatly improved.
4. Consider some types of improvements for employees, such as a public telephone, and/or perhaps a television set for army troops and employees.
5. A better effort should be made to accommodate and educate truck drivers hauling cattle. Pass out program literature and small souvenirs.
6. Provide a better lighting system for work at night at the highway and within the facilities.
7. Consideration should be given to (1) moving the quarantine stations easterly as the critical line moves and (2) assurance that railroad traffic is adequately inspected.

13. Information and Public Education

The information section of the program currently has a staff of 28 employees. The section has maintained a vital presence in mass media efforts, producer education, publication development, document preparation, and visual aides production for Commission employees. The information section has taken an active role in promoting and maintaining public awareness to support surveillance in the eradicated or screwworm-free zones.

The need for an innovative, progressive and productive information section will be mandatory for the successful implementation of country wide surveillance. Mexico is a physically large land mass with diverse cultures, topography and ecological conditions. The greatest threat of screwworm reinfestation is currently in free areas where employee numbers have been greatly reduced. Early detection of any new fly infestations north of the present critical line is a major goal of surveillance and thus a major responsibility of the information section. Effective surveillance will depend on a strong public educational program in the next 3 to 5 years.

Supervisors of the information section from Washington have recently requested a reduced emphasis in staff time devoted to the screwworm information program. The Public Affairs Officer in Mexico has provided 50 percent of her time to Commission duties for the past few years. She has been asked by her administrative supervisor to provide equal time to the three programs which the information section serves. New information demands from PPQ programs in citrus canker and boll weevil management will conflict with needed duties for the screwworm information program.

The outbreak of screwworms in the San Luis Potosi area during June and July, 1985, demonstrates the need for a strong public information program. The livestock industry must be constantly aware of the need for fly surveillance. A cost of \$1 million was required to eradicate this summer outbreak. The emergency program cost approximately \$5,000/active case during the outbreak.

The information section is in urgent need of a computer system for text preparation and graphic capabilities. The present system of maintaining addresses, addressing envelopes, stuffing newsletters and developing the newsletter is all achieved with long hours of hard work by dedicated people. The art section has devoted numerous after duty hours, without any compensation, for the preparation of visuals for meetings and presentations.

The Commission is in the process of supporting and improving the honorary inspector program to maintain support of the livestock industry and cattlemen's unions. This is a large project to communicate with over 10,000 Mexican livestock owners to enhance field surveillance. Great idea! The Public Affairs Officer has justified a request for outside assistance in evaluating and planning future public information programs. The request was not approved. The entire program is in a transitional phase from active eradication to a surveillance and a preventive program. The public information responsibilities are to be turned over to field operation personnel in the proposed organizational changes. There will be a significant need for innovative training techniques and special information strategies needed in the future.

The information section provided the review team with an impressive list of educational activities and publications developed in the past year. The information section is to be commended for its professional approach to its duties and achievement of established goals.

Recommendations:

1. Consider the advice of a consultant team of three members to evaluate and provide future planning and innovative strategies for the information section. Special techniques and programs will be needed to enhance public information activities.
2. Administrative planning and innovative methods for the information program will increase in importance. The screwworm program needs the services of a full time information officer under the direct supervision of the program co-directors.
3. Provide a computer system for document preparation and graphics for the information section. This must include the capabilities of envelope addressing and stuffing.
4. It would be helpful to develop new movie films to aid in public education. A film on the current status of the entire program would be helpful. A second film is needed to stress the need for the screwworm surveillance. It should stress the game plan to maintain fly-free areas and the role to be played by each group in the public and governmental sectors.
5. The initial effort for honorary field inspectors should be updated with a survey of participants, additional information and expanded involvement.
6. Mass media efforts should be planned to inform the public of program benefits when available. Let the public know its money invested in eradication is paying excellent dividends.

14. Fly Distribution

Major improvements have been made in fly distribution since our last visit. The chilled system of storage and transfer of pupae has been reinstituted, resulting in a much better fly being delivered to the distribution centers. The contract trucker and his worn out equipment have been replaced by program trucks and tractors, resulting in a great improvement in the ground shipment of flies.

We observed the Omega guidance systems installed in the aircraft; however, we received conflicting reports as to how effective and reliable these systems are in performing their function. We also heard reports that a new and supposedly better guidance system is being investigated.

No advancement in the use of the small boxes and the new packaging machine has been made since our last visit. It was reported that the small box system was tested again in the past year. One source reported the system worked great, and another source reported a problem with box opening. Box opening could be solved if it is a purely mechanical problem.

The response to our questions about the chill fly distribution system proposed to air drop adult flies was one of surprise. The many technical requirements of critical temperatures, prompt delivery, humidity control and physical handling of flies as adults totally violate the principle of keeping systems simple. The Team thought work on this system has been abandoned. The concept is too complicated to implement.

Recommendations:

1. Make the Omega or another accurate and dependable guidance system work for locating and following flight patterns.

2. Abandon the chilled fly concept.
3. We urge that the conflict about the small box system be resolved.

15. Yucatan, Guatemala and Belize

The agreement of 1972 has been amended to allow the Commission to release flies in the area of Mexico below the barrier, and the operation is now proceeding. This serves two purposes. First, it removes fertile fly pressures from the barrier and the quarantine line; and second, it brings all of Mexico into the program. Ranchers in the Yucatan Peninsula have long been asked to cooperate fully with the program, but to date they have received few tangible benefits.

As the eradication in this part of Mexico proceeds to essential completion, it is obvious that the area cannot be kept free of screwworms until eradication is also done in Belize and in Guatemala north and west of Guatemala City. We trust that authority to proceed with negotiations with Belize and Guatemala will soon be forthcoming. In this case, the fact that Mexican states on the peninsula have already been cleaned up would be of great advantage.

Recommendations:

1. Proceed with eradication work in Mexican states on the Yucatan Peninsula, and simultaneously proceed to establish agreements for eradication in Belize and Guatemala.

16. Methods Development

The purpose of Methods Development is to continuously evaluate production and utilization technologies, identify potential improvements relative to available materials and equipment, and recommend alternatives to appropriate line managers. This ideal serves as a guideline from which more specific objectives and priorities can be established. Methods Development in the screwworm mass-rearing facility at Tuxtla Gutierrez is currently responsible for building large colonies of new strains provided by ARS Research, determining the production characteristics of these new strains, developing new diets for larvae and adults, and recommending improved procedures and products. There are important activities, but some of them have inappropriately led to in-house research projects at the expense of other more essential needs.

We recommend that Methods Development concentrate on adapting existing computerized quality control technology for use in monitoring screwworm production. This can be accomplished by cooperating with APHIS and ARS personnel located in the U.S. and Central America. Routine quality control tests and evaluations, along with bioassays of all rearing materials and supplies, could then be conducted by Methods Development. It also could play an important part in security of the rearing facility, including all measures necessary to prevent fly escape. Security at the entrance, hot rooms, incinerators, other outlets, and unintentional openings should be monitored by a single responsible entity and checked by the existing safety committee. Methods Development should continue to evaluate but not attempt to invent new materials and equipment for use in screwworm production. Invention is a research function beyond the scope of Methods Development. Finally, it

could investigate facility designs and operation protocols in anticipation of expanding the screwworm eradication program into Central America.

The position of Methods Development between Research and Production necessitates overlapping interests and functions. For example, ARS develops strains that are reared in the production facility and ultimately given to Production for use as the release strain. ARS research on new diets also follows this course. Consequently, a workable system should be devised to communicate the needs of Production to Methods Development and ARS. In turn, these entities must be careful to clearly and expeditiously communicate the methods and results of their work. This is an important component of the spirit of cooperation that has continued to develop as the screwworm program has matured.

Recommendations:

1. Conduct quality control monitoring of screwworm production and routine bioassays of all rearing materials to assure their purity.
2. Accept significant responsibility for security at the screwworm production facility and all measures required to prevent fly escape.
3. Seek and evaluate the best technology from every possible source to improve materials and equipment for screwworm mass production and utilization.
4. Investigate facility design and operation protocols in anticipation of needs in Central America.
5. Continue to develop and maintain closer liaison and mutually beneficial working relationships with ARS.

17. Research

The screwworm eradication program has an exceptionally competent, well-organized allied ARS research capability that is appropriately directed at developing a greater understanding of the basic ecology, genetics, and behavior of this insect. They have scientists and laboratories at key locations in Costa Rica and Texas as well as Tuxtla, with able technical support in Fargo, North Dakota. This cadre of scientists currently develops new strains for mass production, researches novel rearing methods, oversees the evaluation of rearing supplies, and provides emergency support almost on demand. They also investigate monitoring techniques for surveying wild screwworm populations and evaluating field tests of factory strains, screwworm survival and development, the comparative ecology of related blowfly species, colonization and maintenance of wild-type characters, genetic sexing, and chemosterilization.

Basic research is even more important following successful eradication in the north and advancement of the program into new, more tropical habitats. Work must continue on low density surveillance techniques, systemic insecticides, genetic sexing, chemosterilization, genetic markers, behavioral mechanisms of the sterile insect technique, the systematics of blowflies, and improved rearing methods. It is essential, however, to assure the continued autonomy of ARS so that its long-term work is not displaced by service functions. Immediate assistance to the screwworm program usually can be provided through technical advice and training. For example, protocols for strain development have been implemented through the cooperative efforts of production, methods, and research personnel. In the event that ARS scientists must attend to immediate program needs, the cost should be borne by APHIS.

ARS research is dedicated to the investigation of screwworm biology relevant to its control and transfer of this knowledge to the eradication effort. Currently, the budget and facilities are adequate, but staff is lacking in critical areas such as insect rearing/nutrition, population modeling, behavior, and perhaps systematics. Visiting scientists could be used to fill these and other gaps if appropriate personnel cannot be recruited. For instance, toxicologists and physiologists may be required to test a variety of new insecticides, insect growth regulators, feeding inhibitors, and toxicants that have been developed for insect control. Formulation, method of application and dosage may need to be altered to achieve success. The screwworm program should continue to avail itself of this kind of valuable resource for solving both immediate and long-term problems but avoid disruption of the independent research.

Recommendations:

1. Continue to work closely with ARS and support its research to discover new technologies for screwworm control.
2. Help preserve the independence and stability of long-term research by using the consultative and training capabilities of the ARS staff, keeping direct involvement to a minimum.
3. Provide for payment of costs required to obtain emergency assistance from ARS.

18. Publication of Successful Eradication Technology

Any pest management effort as expensive and complex as the screwworm eradication program should be scrutinized. However, misguided critics of the program periodically emerge and capture public attention by espousing scientifically unsubstantiated claims that sterile males have not been responsible for past success or that they will cease to be effective in the future. Some published accounts voice unwarranted concern and cast uncomplimentary aspersions on the program. Nearly a decade ago, for example, scientists warned of isolated screwworm populations in Mexico that would be resistant to the sterile male technique, and we were recently advised about climatic changes that would restore currently unsuitable screwworm habitats. Unless quickly and aggressively refuted, this kind of publicity may have a long lasting negative impact on the program.

Virtually everyone involved in screwworm eradication is convinced that the sterile males are effective. They also realize the importance of using every pest management technology available to eliminate screwworms. Therefore, it behooves program managers to encourage the publication of comprehensive assessments of ongoing eradication efforts. These reports must be based on ecologically sound sampling methods, appropriate statistical analyses, and valid conclusions. In particularly definitive situations, such as outbreaks in the eradication zone, islands, and other geographically isolated locations, ARS and other scientists should be asked to participate in the documentation process. The review team is aware, for example, that a special grant was provided to scientists at Texas A&M University to collect survey data from livestock owners in an outbreak area during the summer of

1985. This effort will provide useful data on program benefits to ranchers and the public.

Recommendations:

1. Continue to practice effective screwworm pest management by taking advantage of every possible method for reducing or eliminating their occurrences.
2. Take the initiative in documenting the unequivocal success of the sterile insect technique.
3. Aggressively and expeditiously refute the claims of misguided critics by cooperatively publishing positive rebuttals.
4. Insist that ARS and other scientists participate in documenting successful eradication technology and determining its scientific basis.

19. Strain Development and Replacement

Protocols for strain development by ARS, large-scale rearing by Methods Development, and mass-rearing by Production have been very successful for establishing VF-84 and CH-85. These strains are currently being produced at levels of about 240 and 20 million per week, respectively. Both strains will be released in Yucatan at a combined rate of about 2500 flies per nautical mile. They will be monitored for emergence, mortality, longevity, malformation, survival without food and water, range of emergence, tolerance to handling, and field effectiveness. If the strains prove reasonably comparable, only the youngest will be retained.

Strain development and replacement continues to be an empirical process, based on production data and overall performance in the field rather than on measurable criteria indicative of strain deterioration. It nevertheless is important to define the population that is colonized in terms of the number of individuals contributing progeny and their relative rates of reproduction, hosts and geographical origins, genetic background, and handling. Laboratory production data such as fertility, fecundity, size, rate of development, and subjective factors indicate the population's adaptability. Finally, some estimate is made of their fitness in nature. If all these criteria and a few others are deemed adequate, a new strain is mass-reared and monitored over several generations. Theoretically, subsequent changes are avoidable, due to environmental influences rather than direct changes in gene frequency. These changes would be perceived as deterioration and justification for a strain change.

Currently this pattern of perpetual strain development and replacement is probably the best option, but it is very expensive, both in terms of the resources committed and reduced productivity of new colonies. They undergo

random genetic changes and survive non-random selection pressures that eliminate flies unable to adapt to the laboratory and reproduce. This results in retention of only rapidly developing, highly fertile flies that produce large numbers of viable eggs. It might be possible to save some expense by adding new flies to an existing colony but it would be necessary to assure that they are not simply removed by the same selection pressures that acted on their predecessors. A primary consideration is whether or not these pressures were catastrophic and not recurrent, like a batch of toxic dietary ingredients. The most efficient option would be to carefully rear a strain so that there is minimal laboratory adaptation (divergence from the wild-type population) and maintain it as a separate brood stock from which eggs could be derived for production.

Recommendations:

1. Continue using the existing strain development and replacement protocols, particularly collection of enough egg masses to assure adequate levels of genetic heterozygosity and rearing that provides for an estimate of their viability (i.e. isofemale lines.)
2. The mass-reared strain should have a separate brood stock that receives great care and is precisely monitored for changes. All production processes should be monitored to assure quality rearing.
3. Field performance should be monitored to determine the competitiveness of released strains and they should be replaced only if deemed inadequate.

20. Computerization

We are aware that the Program has expended considerable resources for computer hardware. We are also aware that perhaps parts of the hardware inventory are not compatible with other parts. Nevertheless, we wonder if the Program is taking full advantage of the capability of computers.

We understand that there is, in effect, computer-type communication between Mexico City and Washington, as well as perhaps other APHIS locations in the U.S. This is to be commended. However, it was not clear that such connections are present between Mexico City and Tuxtla. Such an arrangement would seem desirable. Though some other programs may be in operation, we were not made aware of them. For example, is there such a program in operation for fiscal affairs, such as payrolls and materials purchasing? Personnel records? It occurred to us that the various details related to production (and distribution) should be immediately recallable by computer. A constantly updated program on the details of daily production and quality measurements could provide management with information on trends, such as egg production, larval weight, etc., etc.

A detailed study of computer hardware and programs on hand and their utilization, along with potential for greater and more efficient use is indicated.

Recommendations:

1. Inventory the total computer hardware and programs on hand.
2. Utilize computer expertise, either inside or outside of the Program, to make full use of computer potential for the Program.

21. Labor Relationships

The Screwworm Eradication Program in Mexico has continuously dealt with the wide variety of labor issues involving the SARH labor union. The threat of slowed work and numerous labor strikes have been a weekly concern. The labor union leaders seemingly search for any debatable item, regardless of how small, to significantly disrupt program operations. Union leadership has routinely disregarded rules of fair play, negotiation and reason to bring about work stoppages and labor revolts. Mexican and American program directors are to be commended for their long and dedicated hours of work provided to resolve extremely difficult labor relationships.

A typical labor problem is the recent crisis regarding termination of 138 employees that are no longer needed by the program. Administrators have been exceedingly generous in the relocation and orderly termination of displaced workers but negotiations to solve this problem according to established treaty regulations have not met with prompt success. Open and detailed discussion of this recent labor problem were fully explored but not solved at the Cancun Commissioners' meeting in May, 1986.

A most important opportunity may occur in the near future to deal firmly with the long term Mexican labor problems. Program operations will be in a transitory phase in the months ahead if proposed plans for Belize, Guatemala and possibly Jamaica come into focus. The international involvement of several countries in joint eradication programs could become a clear possibility. Then positive steps could be taken to use the international aspects of future operations to reorganize the whole labor issue.

Recommendations:

1. Develop strategies to exclude the Mexican labor union from the labor management system if international agreements are developed for future multi-national programs.

2. Develop written documents to resolve special "one time" labor problems which appear to have no clear resolution under existing operating procedures.

We can appreciate the differences in personalities and in cultures that inevitably exist in such an international operation. It occurs to us that there are some points that may be worthy of consideration to keep such conflicts at a minimum. The first is set forth in Section 27, Short and Long Range Program Goals. If such goals are jointly worked out at the Mexico City level and set forth as Corporation policy at all levels, there should be fewer decision situations at lower management levels that are conducive to rapid disagreement. A second point is the need for constant training and orientation by both the U.S. and Mexican authorities on the need for amicable attitudes by counterparts.

Recommendations:

1. Follow through on cross-national agreement on short and long range program goals as set forth in Section 27.

2. Maintain constant training and orientation on the need for amicable attitudes by both U.S. and Mexican nationals.

22. Relationship with Mexico

It would seem apparent, based on the success of the screwworm program to date, that working relationships between U.S. and Mexican people in the Program are excellent. This is apparently true at the highest levels of management, but it is not quite so smooth at other management levels. The Team was advised of several situations where disagreements were common, resulting in considerable loss in efficiency and/or effectiveness.

We can appreciate the differences in personalities and in cultures that inevitably occur in such an international operation. It occurs to us that there are some points that may be worthy of consideration to keep such conflicts at a minimum. The first is set forth in Section 23, Short and Long Range Program Goals. If such goals are jointly worked out at the Mexico City level and set forth as Commission policy at all levels, there should be fewer decision situations at lower management levels that are conducive to rabid disagreement. A second point is the need for rather constant training and orientation by both the U.S. and Mexican authorities on the need for conciliatory attitudes by counterparts.

Recommendations:

1. Follow through on cross-national agreement on short and long range program goals as set forth in Section 23.
2. Maintain constant training and orientation on the need for conciliatory attitudes by both U.S. and Mexican nationals.

23. Short and Long Range Program Plans

Historically, the unifying goal of eradicating the screwworm has been apparent to virtually everyone involved with the program. Its achievement in the U. S. and most of Mexico, however, has resulted in the evolution of four much less obvious and definable components: Surveillance in the north, barrier maintenance at 93⁰, incipient eradication in Yucatan, and advanced planning for a campaign in Belize and Guatemala. These new facets require very different management approaches than their antecedent, the eradication mandate. The assignment of personnel, allocation of resources, and establishment of priorities are directly affected by this division of purposes, as are the required degree of flexibility and coordination. The existing program fortuitously has the requisite sophistication to handle this degree of flexibility.

In light of the new program, it became apparent to the review team that there is a need for administrative staff members to establish and systematically (quarterly) assess the progress of short and long term program goals. This effort is needed to reunify all employees and assure that they understand their specific goals. Several discussions about the program clarified this need. They all ended in a disturbing and questioning point: What is the primary objective of the present screwworm program in Mexico? All workers and administrators we interviewed seemed to be quite intent on accomplishing current tasks and duties in a businesslike manner; however, there was an obvious lack of direction toward a common primary goal. The only constant feeling was that of being in a temporary "holding pattern". This is not conducive to good worker morale or long term goal achievement.

The avoidance of tactical errors by formulating short and long range plans for administrative decisions affecting program direction, labor management, implementation and funding, etc., are of paramount importance.

Certain major program decisions, such as the initiative to eradicate the Yucatan, could jeopardize future agreements. Relocation of required quarantine stations is a pertinent example. The complexities of dealing in an international community where participants have different motivations and priorities can be most demanding, if not impossible, without plans with written agreements.

Recommendations:

1. Have a committee of strategists to develop and document both short and long range goals with a clear anticipation of events for each facet of the screwworm program.
2. Formulate a long range plan for allocating resources and managing labor.

24. Liaison with Other Global Insect Control Programs

Global insect pest management programs share common technologies and logistical problems, particularly those in Mexico and Central America that utilize the sterile insect technique. These programs should consequently be linked so that solutions to shared problems can be readily exchanged rather than redevise. They all employ mass rearing technologies, for example, that include large-scale facility design and construction, automated irradiation units and other equipment process engineering and maintenance, computerized quality control procedures, and strain development and replacement requirements. Moreover, these programs all have similar management methodologies, logistical and political constraints, surveillance and quarantine requirements, aircraft delivery systems, administrative support services, and governmental regulations. These global insect control programs are thus more defined by their incorporated activities than by the biologies of the insects they are intended to manage.

Specifically, we are thinking about the vast experiences and current operations of both VS and PPQ in Mexico and Central America. VS is, of course, involved with the screwworm and PPQ with the Mediterranean Fruit Fly. We believe it would be helpful to both agencies to share experiences, technology, and perhaps other aspects. We do not view the activities of VS and PPQ as being competitive in any way. We have great respect for the vigor, technology, and accomplishments of both.

Recommendation:

1. Link the management and operation of Mexican and Central American global insect control programs to encourage the sharing of solutions to common problems and thereby avoid wasteful redundancy.

25. Documentation of the Screwworm Eradication Program

In our review in 1983 and reaffirmed in 1984 we recommended the preparation of a document that detailed the full story on the development, execution, and completion of the eradication program and the establishment and maintenance of the barrier. We understand that the preparation of the document has been, or is about to be, contracted to an appropriate person. We wish to commend APHIS-VS for this decision. We trust that the matter is now essentially in good hands and will be forthcoming.

Recommendation:

1. Follow through with the contractor to ensure timely preparation and completion of the document.

26. Program Benefits in Mexico

The review team acknowledges the financial support provided to a team of Extension specialists at Texas A&M University currently conducting a study of the economic benefits of the Mexican-American Screwworm Eradication Program. It is our understanding the final report of the group will be provided in August, 1986. The anticipated report is to scientifically document the direct program benefits to Mexican cattlemen, Mexican consumers, and the projected social enhancements of screwworm eradication.

This study has been hampered by the lack of documented background data on infestation levels and their costs to cattlemen before fly eradication was initiated. The survey effort in Mexico during the past year had to depend on a historical recall of losses by survey participants. Historical recall must be used because the data for past economic losses do not exist. To prevent this problem in the future, program administrators are urged to develop a scientific profile of loss information in future eradication areas before eradication procedures are initiated. It would be wise to accurately determine natural infestation levels and economic loss data in Guatemala and Belize before sterile flies are dropped in any eradication program.

The public and government offices in Mexico should be informed of the beneficial returns of public funds invested in screwworm eradication. Plans should be initiated to use economic benefit data to clearly project the cost/benefit analysis of the joint Mexican-American Commission activities.

Recommendations:

1. Develop a public information program to demonstrate the economic returns for public funds invested in screwworm eradication.

2. Initiate a background data collection effort in Belize and Guatemala to document the infestation level of screwworms and the economic losses associated with the pest in these two areas. This must be initiated in the near future before eradication efforts are started.

27. South of the Barrier Zone

In our 1984 report we stated why we thought the screwworm should be eradicated all the way to the Darien Gap (Panamanian-Columbian border.) Our discussion terminated with the recommendation that the U.S. proceed with the appropriate countries to accomplish this eradication endeavor.

We still recommend that this be done. We are delighted that at least informal discussions are proceeding with the next two nations below Mexico, Belize and Guatemala. These discussions are being done by representatives of the Mexican-American Commission. It is beyond the Team's knowledge and capability to discuss whether operations in nations other than Mexico could or should be done by the Commission or by the U.S. alone. That must be determined, of course, before operations proceed in other nations, but we do wish to again support the concept of eradication to the Darien Gap.

Recommendation:

1. That the U.S. proceed, under whatever international arrangements are feasible, to plan and carry out an eradication program to the Darien Gap.

28. Subsequent Review

While we have had no official feedback on the helpfulness of our previous reviews, we are convinced that they have been worthwhile. Therefore, we should like to encourage a subsequent review. We believe that the timing of the review should depend on the progress of the program. There are obviously four components about which APHIS-VS officials will have constant concern. They are (1) the success of the surveillance and information program above the barrier; (2) the maintenance of the barrier including the effectiveness of quarantine operations; (3) the progress of the eradication efforts in the Mexican states in the Yucatan; and (4) the progress of plans to move the program into Guatemala, Belize, and Central America. It seems to us that an analysis of these four components, plus any other appropriate items, sometime in 1987 would be helpful to the program.

Recommendation:

1. Plan a review by non-APHIS scientists at a logical time during 1987.

